REMARKS

This is in response to the Official Action of April 24, 2006. In that Office Action, all claims were rejected as obvious. Specifically, claims 1-17 were rejected under 35 U.S.C. § 103(a) as being unpatentable over United States Patent No. 4,837,107 to *Axelsson et al.,* in view of United States Patent No. 4,254,201 to *Sawai et al.*, and in further view of United States Patent No. 6,416,918 to Matsumura et al. Claims 18-20 were rejected as obvious over Ax*elsson et al.* in view of *Matsumura et al.*

Claims 1, 17, and 18 have been canceled and new claims have been added to more particularly define the invention. The amendments are fully supported in the application as originally filed, and no new matter has been included. Specifically, the amendments to claims 2-16 and 19 are formalities. The amendments to Claim 20 are supported at page 10, line 25 through page 11, line 5; page 16, lines 10-16; and examples 4-6. New claim 21 is supported in the application as originally filed at page 10, line 10; page 10, line 25 through page 11, line 5; and examples 1-3. New claim 22 is supported at page 11, lines 1-5. New claim 23 is supported in the application at page 9, line 28. New claims 24 and 25 find support at page 17, line 14. New claim 26 is supported at page 12, lines 3-4. New claim 27 is supported by original claim 1 and throughout the application. New claim 28 finds support in original claims 1 and 16; page 7, lines 9-10; and in Fig. 1.

As amended, this application is believed in condition for allowance, particularly in view of the enclosed *Declaration* of Hyun-Nam Yoon. The art of record does not teach or suggest a method of preparing a toner composition by blending the colorant composition and core resin particles at sufficient shear to create electrostatic forces which bond the colorant directly to the resin core. According to the invention, a toner composition may be produced which has (1) a small particle diameter; (2) a narrow particle size distribution; and (3) a high colorant loading. These elements are critical for producing toner that may be used effectively in high resolution color electrophotography.

Claim 21, representative of the claimed subject matter, is reproduced below.

> Claim 21. A method of producing a toner composition for developing latent electrostatic images comprising the steps of:
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> (a) providing toner core particles comprising a meltable resin with a volumetric mean diameter in the range of about 3 to about 12 μm; and
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> (b) mixing the toner core particles with a powder colorant composition at a sufficient shear rate and for a sufficient time such that the toner core particles are directly adhered to the surface of the toner core particles primarily by electrostatic forces, wherein the colorant composition is present in amounts of from 3 to 30 weight percent of the toner composition, and wherein the ratio of the volume average diameter of the core toner particles to the volume average diameter of the colorant powder particles is at least about 5.

As can be seen, independent claim 21 recites that the toner composition is produced by electrostatically binding the colorant to the core where, the toner core particles are small (about 3-12 μm) and the colorant loading ranges from 3-30 percent. The mixing techniques used in the invention produce the aforementioned properties which are critical to high-resolution applications, without encountering the difficulties involved with conventional melt blending techniques. See, pending application at page 17, lines 17-21:

> **[0043]** The average diameter of toner particles needs to be smaller as the image resolution of a laser printer increases. However, even with the small size toners, the high image resolution also requires the file height of toner layer on paper to be small. This then necessitates a high colorant loading in the small size toner. Typically, 600 dpi toner particles contain a colorant in the amount about 5-8 wt. % with the particle mean diameter in the order of 8 μm. However, to achieve 2400 dpi resolution, it is expected that the toner particles diameter needs to be from about 3 about 4 μm and the colorant loading in the order of from about 15-20 wt. %. Accomplishing this with a conventional melt blending cre-

> ates several significant difficulties. First, dispersing such a large amount of colorant in a resin requires a long and extensive mixing operation, which is expensive and often results in degradation of the resin. The particle formation process also becomes difficult to control as the dispersed colorant particles act as physical crosslinks. In contrast, the process of this invention allows incorporation of a large amount of colorant particles onto toner particles in a reproducible manner.

The art cited by the Examiner is not at all suggestive of the claimed features, because the references teach conventional methods of depositing a colorant on the resin core particle. In this regard, the primary reference cited by the Examiner, *Axelsson et al.*, relates to a method for producing core/shell type toner particles having a specific diameter and size distribution, where the colorant composition is distributed in the shell resin. The *Axelsson et al.* reference notes in col. 9, that the that the pigment may optionally be distributed on the base particle by mechanical treatment, prior to application of the shell resin. See, e.g., col. 9 of *Axelsson*:

> The colorant can be added to the base particles before the polymer powder, solution or dispersion is added, e.g. by making a liquid colorant wet or penetrate the base particles, optionally in the presence of a solvent as a means for aiding diffusion. Alternatively, a solid colored substance such as a pigment can be distributed on the base particle surface e.g. by being treated mechanically together with the base particles. A solvent or dispersion agent can optionally be used also in this case to facilitate the adhesion of the pigment particles to the base particles and/or to soften the surface of the base particles to improve the retention of the particles. Meth-

This is not suggestive of the inventive method, however, because while the above passage may suggest some adhesion by mechanical agitation, it does not indicate that high quality toner composition may be produced by simply blending the composition at a given shear. *See*, *Declaration* at paragraph 6. Nor does it suggest the claimed colorant loadings coupled with small toner particles—features critical to high-resolution printing applications.

As stated in the *Declaration* of Dr. Yoon at paragraph 6, the method of the invention is surprising in view of the *Axelsson et al.* patent because the invention enables the production of high-resolution toner using simple and economical techniques. It has been found in connection with the instant invention that when the colorant particles are blended with the resin core particles, particularly at lower temperatures, the particles develop a strong attractive force to each other, allowing the colorant particles to deposit themselves in sufficient quantities on the core particles and become securely affixed thereto, even though the components are mixed at temperatures where the resin core is not in a melted state. The high quality of the toner produced by the inventive method is surprising, because a person of ordinary skill in the art would not expect the colorant particles to adhere to, and distribute on the resin core in sufficient amounts, unless the resin core was heated to a softened or melted state. *Id.*

The unexpected results of the invention are illustrated with reference to Example 2 of the pending application, where it is seen that a toner that is produced by affixing colorant particles to core particles, primarily by combining them together under high shear, produces a toner composition which exhibits good printing properties. *See*, application as originally filed at page 21:

> meltable resin core surface. Electrostatic charging properties of the yellow toner composition were determined by a blow-off method using a Faraday cage (Vertex Charge Analyzer, Vertex Image Products, Yukon, Pa.). The charge of toner after 1 minute mixing with Type-22 carrier was –27 μC/g. Fusing property of the toner was determined using a custom-designed heated roll-type fusing tester. A small amount of toner was spread on a sheet of paper and was passed through a pair of heated roller at a linear speed of about 720 cm/min. When the roller temperature was below 140° C., cold offset phenomena was observed and, above 220° C., hot offset was observed, resulting in a very large fusing latitude of 80° C. for the toner composition. Further, the toner sample was introduced into a cartridge of HP-4500 printer and patterns were printed. Line acuity and solid patches with a uniform optical intensity 1.17 of were observed after printing 5,000 pages.

As noted in the attached *Declaration* at paragraph 7, it is surprising that good colorant adhesion and high printing quality can be achieved using the simple method of the invention, even where the toner is produced without a shell resin.

In contrast to the simple process of the invention, the *Axelsson et al.* reference suggests as a whole that, in order to provide for sufficient colorant adhesion the colorant composition should be melt bonded to the core resin with a shell polymer, or applied to the core with a shell polymer that is in liquid form. As stated in the *Declaration* at paragraphs 8 and 9 (reproduced below), the *Axelsson* and *Matsumura et al.* references cited by the examiner are not suggestive of electrostatic bonding for toner compositions, and instead suggest that melt-bonding is critical for sufficient adhesion for toner applications:

> 8. That *Axelsson et al.* generally suggests that substantial melt bonding is required for adequate adhesion. *See*, *Axelsson* , at col. 11:
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> > The polymer can also be added in dry powder form to the base particles. The addition of the polymer and a colorant is made under agitation and at a temperature which is sufficiently high for allowing adhesion of essentially the entire amount of added shell-polymer to the surface of the base particles and at a temperature which is sufficiently low for preventing any substantial mutual agglomeration between the base particles, both the uncovered and the covered.
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> 9. That, the above passage in *Axelsson et al.* represents the conventional view that the colorant particles should be blended with the core components and shell resin under heat in order to provide sufficient adhesion. That accordingly, in his opinion, the *Axelsson et al.* reference is not remotely suggestive of the claimed invention, as amended. That the remaining art of record also does not teach the claimed subject matter. For example, *Matsumura et al.* makes reference at col. 1 , lines 26+ of the conventional melt-kneading of pigments into toner resins.

The *Axelsson et al.* and *Matsummura et al.* references are accordingly not

remotely suggestive of the claimed subject matter because they do not teach to blend the colorant component with the core resin to electrostatically affix sufficient amounts of the colorant composition to the core resin to provide a high-resolution toner. The *Sawai et al.* reference is not believed to be particularly relevant to this case, because it is directed to a pressure sensitive adhesive toner, comprising a cluster of encapsulated granules. The encapsulation operation is not pertinent to the claimed methods and compositions.

Claim 21 additionally recites that the colorant composition is directly adhered to the core shell. This feature is seen in Figs 1 and 4 in the pending application. The *Axelsson* reference teaches away from this limitation because *Axelsson* recites that the toner particles included a shell in which a colorant is distributed. *See*, Abstract of *Axelsson*. Indeed, the *Axeslson* reference teaches that it is critical to evenly distribute the colorant throughout the shell polymer for proper adhesion. *See*, col. 10, lines 9-23 of *Axelsson*. As stated by Dr. Yoon in the attached *Declaration* at paragraph 10, the structure of the *Axelsson* composition differs because, instead of being distributed throughout a shell resin, the inventive toner particles are present as discreet particles on the core particle surface, and the colorant layer generally does not include any shell resin. Accordingly, claim 21 should be allowed to issue.

Claim 20, in addition to including many of the above-mentioned features, recites the inclusion of a powder resin component which is provided with colorant and is *subsequently* melted on the core particle. Here again, while the *Axelsson et al.* reference uses a shell polymer in the toner composition, it teaches, in contrast to the present invention, to blend the polymer components and colorant composition when the core particles are in a melted or softened state. *See*, *Axelsson et al.* at col. 11, lines 10-34.

Independent claim 28, reproduced below, is similarly patentable:

> Claim 28. A particulate toner composition for developing latent electrostatic images consisting essentially of a resin core and colorant composition particles, where the resin core has a volume average diameter, D_p, and the colorant composition

> particles have a volume average d_p, wherein the ratio of D_p/d_p is at least about 5 and the weight fraction, wherein the colorant particles are directly adhered to the surface of the resin core, in amounts of from 3 to 30 weight percent of the toner composition.

As with claim 21, independent claim 28 also recites a toner composition where the colorant is directly adhered to the core resin at a loading of 3-30 %. Furthermore, claim 28 relates to toner composition which consists essentially of the core resin and the powder colorant, *i.e.*, the toner encompassed by claim 28 does not include a protective outer polymer layer. This structure is clearly distinguished over the *Axelsson* patent which requires a shell polymer. Claim 28 should likewise be allowed.

New claims 24 and 25 are believed particularly patentable because they relate to an embodiment where the toner composition has both a heavy colorant loading and a small particle size. As noted in the pending application at line 15 +, this is significantly difficult to accomplish using conventional techniques. Moreover, it is surprising that such elevated pigment levels can be achieved using such a simple technique.

The foregoing points are underscored by the *Declaration* of Dr. Yoon at paragraph 11, where he notes that core-shell toner composition, such as those taught by *Axelsson*, have been widely suggested but are virtually unavailable commercially. This is due to the complex and expensive process required to fuse the shell to core particle, and is clearly distinguishable from the simple, inexpensive techniques used in the invention.

For the above reasons, all claims should be allowed to issue.

Please charge any applicable fees for additional claims to our Deposit Account No. 50-0935. This response is being filed with a *Petition* for a one-month extension of time. If any additional extensions are required, please consider this paper a *Petition* thereof and charge our Deposit Account No. 50-0935.

Respectfully submitted,

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